WHAT IS CLAIMED IS:

1. A digital demodulation apparatus that amplifies, for demodulation, a digital modulated signal wave received through the air with gain automatically controlled for generating a digital signal having a predetermined amplitude, said apparatus comprising:

receive level variation detection means for detecting receive level variation of said received digital signal wave; and

gain adjusting means for adjusting said gain based on said detected receive level variation.

2. The digital demodulation apparatus according to claim 1, wherein

said received level variation detection means detects said receive level variation based on an amplitude of said received digital signal wave.

3. The digital demodulation apparatus according to claim 1, wherein

said receive level variation detection means detects said receive level variation based on an error rate of the received digital signal wave.

4. The digital demodulation apparatus according to claim

1, wherein

said received level variation detection means comprises

tuning means for extracting a desired digital modulated signal from said received digital modulation waves, and generating a first digital modulated signal;

automatic gain control amplification means for amplifying said first digital modulated signal with said gain, and generating a second digital modulated signal;

digitizing means for converting said second digital modulated signal into a third digital modulated signal; and

tuned signal receive level variation detection means for detecting receive level variation of said first digital modulated signal based on an amplitude of said third digital modulated signal, and

said gain adjusting means adjusts said gain based on the detected receive level variation of the third digital modulated signal.

5. The digital demodulation apparatus according to claim 4, wherein

said tuned signal receive level variation detection means further comprises

amplitude detection means for detecting an amplitude value of said third digital modulated signal;

average-filtering means for carrying out average-

filtering on said detected amplitude value with a predetermined averaging coefficient to detect an average amplitude value;

error detection means for detecting an error between said detected average amplitude value and a desired average value; and

loop filter means for carrying out loop filtering on said detected error with a predetermined integral coefficient, and generating a stabilization signal for stabilizing an automatic gain control amplification process, and

said tuned signal receive level variation detection means detects said receive level variation based on the generated stabilization signal.

6. The digital demodulation apparatus according to claim 5, wherein

said tuned signal receive level variation detection means further comprises difference detection means for detecting a difference between arbitrary two values of said stabilization signal, and

said receive level variation is detected based on a comparison result obtained by comparing said difference with a predetermined threshold.

7. The digital demodulation apparatus according to claim 6, wherein

said tuned signal receive level variation detection means generates a level variation signal indicating said comparison result, and said gain control means controls said gain based on the level variation signal.

8. The digital demodulation apparatus according to claim 7, wherein

said average-filtering means is an adaptive averaging filter for adaptively setting said averaging coefficient based on a value of said level variation signal, to enable digital signal demodulation with high quality by appropriately setting the averaging coefficient based on said detected receive level variation.

9. The digital demodulation apparatus according to claim 8, wherein

said average-filtering means includes a first averaging coefficient and a second averaging coefficient larger than the first averaging coefficient, selects the first averaging coefficient if the detected level variation in said level variation signal is smaller than said threshold, and selects the second averaging coefficient if the detected level variation in said level variation signal is not smaller than said threshold.

10. The digital demodulation apparatus according to claim

7, wherein

said loop filtering means is an adaptive loop filter for adaptively setting said integral coefficient based on said level variation signal to enable digital signal demodulation with high quality by appropriately setting the integral coefficient based on said detected receive level variation.

11. The digital demodulation apparatus according to claim 10, wherein

said loop filtering means includes a first integral coefficient and a second integral coefficient larger than the first integral coefficient, selects the first integral coefficient if the detected level variation in said level variation signal is smaller than said threshold, and selects the second integral coefficient if the detected level variation in said level variation signal is not smaller than said threshold.

12. The digital demodulation apparatus according to claim 6, wherein

said tuned signal receive level variation detection means further comprises

PWM calculation means for converting said stabilization signal into a square-wave signal represented by 0 and 1; and

low-pass-filtering means for extracting low-frequency

components from said square-wave signal to generate a low-frequency, square-wave signal, and

said tuned signal receive level variation detection means detects said receive level variation based on said low-frequency, square-wave signal.

13. The digital demodulation apparatus according to claim 12, wherein

said gain adjusting means adjusts said gain based on said low-frequency, square-wave signal.

14. The digital demodulation apparatus according to claim 12, wherein

said tuned signal receive level variation detection means further comprises gain adjusting signal generation means for generating, based on said low-frequency, square-wave signal, a gain adjusting signal for adjusting gain of said automatic gain control amplification means, and

based on said gain adjusting signal, said tuned signal receive level variation detection means detects said receive level variation.

15. The digital demodulation apparatus according to claim 14, wherein

said gain control means controls said gain based on said

gain adjusting signal.

16. The digital demodulation apparatus according to claim 4, wherein

said tuned signal receive level variation detection means further comprises

Hilbert filtering means for extracting quadrature components from said third digital demodulation signal;

detection means for detecting and correcting an error between a frequency of said third digital modulated signal and an oscillation frequency of said tuning means, and frequency-converting the error-corrected third digital modulated signal into a baseband signal;

interpolation filtering means for converting said baseband signal into symbol-rate frequency data based on system-clock frequency data;

roll-off filtering means for extracting low-frequency components from said symbol-rate frequency data at a desired roll-off rate, and generating low-frequency, symbol-rate frequency data;

waveform equalizing means for eliminating distortion caused by a transmission path from said low-frequency, symbol-rate frequency data;

error correction means correcting an error caused by the transmission path and occurring in said waveform-equalized,

low-frequency, symbol-rate frequency data; and

error rate detection means for detecting an error rate of said third digital demodulation signal, and

based on the detected error rate, the receive level variation detection means detects said receive level variation.

17. The digital demodulation apparatus according to claim 16, wherein

said tuned signal receive level variation detection means further comprises

amplitude detection means for detecting an amplitude value of said third digital modulated signal;

average-filtering means for carrying out average-filtering on said detected amplitude value with a predetermined averaging coefficient to detect an average amplitude value

error detection means for detecting an error between said detected average amplitude value and a desired average value; and

loop filter means for carrying out loop filtering on said detected error with a predetermined integral coefficient, and generating a stabilization signal for stabilizing an automatic gain control amplification process, and

said tuned signal receive level variation detection means detects said receive level variation based on a comparison result obtained by comparing said detected error rate with a

predetermined threshold.

18. The digital demodulation apparatus according to claim 17, wherein

said tuned signal receive level variation detection means generates a level variation signal indicating said comparison result, and said gain adjusting means adjusts said gain based on the level variation signal.

19. The digital demodulation apparatus according to claim 18, wherein

said average-filtering means is an adaptive averaging filter for adaptively setting said averaging coefficient based on said level variation signal to enable digital signal demodulation with high quality by appropriately setting the averaging coefficient based on said receive level variation.

20. The digital demodulation apparatus according to claim 19, wherein

said average-filtering means includes a first averaging coefficient and a second averaging coefficient larger than the first averaging coefficient, selects the first averaging coefficient if the detected level variation in said level variation signal is smaller than said threshold, and selects the second averaging coefficient if the detected level variation in

said level variation signal is not smaller than said threshold.

21. The digital demodulation apparatus according to claim 18, wherein

said loop filtering means is an adaptive loop filter for adaptively setting said integral coefficient based on said level variation signal to enable digital signal demodulation with high quality by appropriately setting the integral coefficient based on said detected receive level variation.

22. The digital demodulation apparatus according to claim 21, wherein

said loop filtering means includes a first integral coefficient and a second integral coefficient larger than the first integral coefficient, selects the first integral coefficient if the detected level variation in said level variation signal is smaller than said threshold, and selects the second integral coefficient if the detected level variation in said level variation signal is not smaller than said threshold.

23. The digital demodulation apparatus according to claim 17, wherein

said tuned signal receive level variation detection means further comprises

PWM calculation means for converting said

stabilization signal into a square-wave signal represented by 0 and 1;

low-pass-filtering means for extracting low-frequency components from said square-wave signal to generate a low-frequency, square-wave signal; and

gain adjusting signal generation means for generating, based on said low-frequency, square-wave signal, a gain adjusting signal for adjusting gain of said automatic gain control amplification means, and

said gain adjusting means adjusts said gain based on the gain adjusting signal.

24. The digital demodulation apparatus according to claim 2, wherein

said receive level variation detection means comprises

tuning means for extracting a digital modulated signal of a desired frequency from said received digital modulated signal wave, and generating a first digital modulated signal;

automatic gain control amplification means for amplifying said first digital modulated signal with said gain, and generating a second digital modulated signal;

digitizing means for converting said second digital modulated signal into a third digital modulated signal; and

tuned signal receive level variation detection means for detecting said receive level variation based on an amplitude

of said received digital modulation wave, and

said gain adjusting means adjusts said gain based on the detected receive level variation.

25. The digital demodulation apparatus according to claim 12, wherein

said tuned signal receive level variation detection means further comprises

amplitude detection means for detecting an amplitude value of said third digital modulated signal; and

average-filtering means for carrying out average-filtering on said detected amplitude value with a predetermined averaging coefficient to detect an average amplitude value;

error detection means for detecting an error between said detected average amplitude value and a desired average value; and

loop filter means for carrying out loop filtering on said detected error with a predetermined integral coefficient, and generating a stabilization signal for stabilizing an automatic gain control amplification process, and

said tuned signal receive level variation detection means detects said receive level variation based on the detected stabilization signal.

26. The digital demodulation apparatus according to claim

25, wherein

said tuned signal receive level variation detection means further comprises difference detection means for detecting a difference between arbitrary two values of said stabilization signal, and

said receive level variation is detected based on a comparison result obtained by comparing said difference with a predetermined threshold.

27. The digital demodulation apparatus according to claim 26, wherein

said tuned signal receive level variation detection means generates a level variation signal indicating said comparison result, and said gain adjusting means adjusts said gain based on the level variation signal.

28. The digital demodulation apparatus according to claim 27, wherein

said average-filtering means is an adaptive averaging filter for adaptively setting said averaging coefficient based on a value of said level variation signal to enable digital signal demodulation with high quality by appropriately setting the averaging coefficient based on said detected receive level variation.

29. The digital demodulation apparatus according to claim 28, wherein

said average-filtering means includes a first averaging coefficient and a second averaging coefficient larger than the first averaging coefficient, selects the first averaging coefficient if the detected level variation in said level variation signal is smaller than said threshold, and selects the second averaging coefficient if the detected level variation in said level variation signal is not smaller than said threshold.

30. The digital demodulation apparatus according to claim 27, wherein

said loop filtering means is an adaptive averaging filter for adaptively setting said integral coefficient based on said level variation signal to enable digital signal demodulation with high quality by appropriately setting the integral coefficient based on said detected receive level variation.

31. The digital demodulation apparatus according to claim 30, wherein

said loop filtering means includes a first integral coefficient and a second integral coefficient larger than the first integral coefficient, selects the first integral coefficient if the detected level variation in said level variation signal is smaller than said threshold, and selects the

second integral coefficient if the detected level variation in said level variation signal is not smaller than said threshold.

32. The digital demodulation apparatus according to claim 26, wherein

said tuned signal receive level variation detection means further comprises

PWM calculation means for converting said stabilization signal into a square-wave signal represented by 0 and 1;

low-pass-filtering means for extracting low-frequency components from said square-wave signal to generate a low-frequency, square-wave signal; and

gain adjusting signal generation means for generating, based on said low-frequency, square-wave signal, a gain adjusting signal for adjusting gain of said automatic gain control amplification means, and

said gain adjusting means adjusts said gain based on the gain adjusting signal.

33. An automatic gain controller that controls gain of a digital demodulation apparatus that extracts a digital modulated signal of a desired frequency from digital modulated signal waves received through the air and generates a first digital modulated signal; carrying out, for amplification, automatic-gain-

controlling on the first digital modulated signal with predetermined gain and generating a second digital modulated signal having a desired amplitude value; and digitizing the second digital modulated signal into a third digital modulated signal, said automatic gain controller comprising:

amplitude detection means for detecting the amplitude value of said third digital modulated signal;

average-filtering means for carrying out average-filtering on said detected amplitude value with a predetermined averaging coefficient, and detecting an average amplitude value;

error detection means for detecting an error between said detected average amplitude vale and a desired average value;

loop filtering means for carrying out loop filtering on the detected error with a predetermined integral coefficient, and generating a stabilization signal for stabilizing an automatic gain control amplification process;

receive level variation detection means for detecting said receive level variation based on said detected stabilization signal; and

average coefficient adjustment means for varying the average coefficient of said average-filtering based on said detected receive level variation.

34. An automatic gain controller that controls gain of a digital demodulation apparatus that extracts a digital modulated

signal of a desired frequency from digital modulated signal waves received through the air and generates a first digital modulated signal; carries out, for amplification, automatic-gain-controlling on the first digital modulated signal with predetermined gain and generates a second digital modulated signal having a desired amplitude value; and converts the second digital modulated signal into a third digital modulated signal, said automatic gain controller comprising:

amplitude detection means for detecting an amplitude value of said third digital modulated signal;

average-filtering means for carrying out average-filtering on said detected amplitude value with a predetermined averaging coefficient, and detecting an average amplitude value;

error detection means for detecting an error between said detected average amplitude value and a desired average value;

loop filtering means for carrying out loop filtering on said detected error with a predetermined integral coefficient, and generating a stabilization signal for stabilizing an automatic gain control amplification process;

receive level variation detection means for detecting said receive level variation based on said detected stabilization signal; and

integral coefficient adjusting means for varying the integral coefficient of said loop filtering means based on said detected receive level variation.

35. An automatic gain controller that controls gain of a digital demodulation apparatus that extracts a digital modulated signal of a desired frequency from digital modulated signal waves received through the air and generates a first digital modulated signal; carries out, for amplification, automatic-gain-controlling on the first digital modulated signal with predetermined gain and generates a second digital modulated signal having a desired amplitude value; and converts the second digital modulated signal into a third digital modulated signal, said automatic gain controller comprising:

amplitude detection means for detecting an amplitude value of said third digital modulated signal;

average-filtering means for carrying out average-filtering on said detected amplitude value with a predetermined averaging coefficient, and detecting an average amplitude value;

error detection means for detecting an error between said detected average amplitude value and a desired average value;

loop filtering means for carrying out loop filtering on said detected error with a predetermined integral coefficient (*AA*, *AB*), and generating a stabilization signal for stabilizing an automatic gain control amplification process;

receive level variation detection means for detecting said receive level variation based on an amplitude of said received digital modulated signal wave; and

averaging coefficient adjusting means for varying the

averaging coefficient of said average-filtering means based on said detected receive level variation.

36. An automatic gain controller that controls gain of a digital demodulation apparatus that extracts a digital modulated signal of a desired frequency from digital modulated signal waves received through the air and generates a first digital modulated signal; carries out, for amplification, automatic-gain-controlling on the first digital modulated signal with predetermined gain and generates a second digital modulated signal having a desired amplitude value; and converts the second digital modulated signal into a third digital modulated signal, said automatic gain controller comprising:

amplitude detection means for detecting an amplitude value of said third digital modulated signal;

average-filtering means for carrying out average-filtering on said detected amplitude value with a predetermined averaging coefficient, and detecting an average amplitude value;

error detection means for detecting an error between said detected average amplitude value and a desired average value;

loop filtering means for carrying out loop filtering on said detected error with a predetermined integral coefficient, and generating a stabilization signal for stabilizing an automatic gain control amplification process;

receive level variation detection means for detecting said

receive level variation based on an amplitude of said received digital modulated signal wave; and

averaging coefficient adjusting means for varying the integral coefficient of said loop filtering means based on said detected receive level variation.